

REMARKS

In view of the above amendments and the following remarks, reconsideration and further examination are requested.

The specification and abstract have been reviewed and revised to make a number of editorial revisions. No new matter has been added. Enclosed is a marked-up specification and abstract indicating the changes incorporated therein.

Claim 3 has been objected to for including the phrase “the thickness superimposed image” which the Examiner contends lacks proper antecedent basis. However, the Examiner’s attention is brought to line 14 of the above-listed claim 1 from which claim 3 depends, which recites “a thickness superimposed image.” As a result, withdrawal of this objection is respectfully requested.

Claim 16 has been objected to as not further limiting claim 15 from which it depends. However, upon reviewing claims 15 and 16, it is apparent that claim 16 goes into much greater detail in explaining how the image of only the second connected part is formed. For example, claim 16 recites the limitation of “adding the image of the overlapping part” which is not recited in claim 15. As a result, withdrawal of this objection is respectfully requested.

Claims 15 and 16 have been rejected under 35 U.S.C. §112, first paragraph, as containing subject matter that was not adequately described in the specification. Specifically, the Examiner has indicated that the limitation “the image forming device binarizes the brightness information so as to form the image of only the second connected part by a bright side level ($A+\alpha$)” is not supported in the specification because the specification only discloses that an image of only the first connection part is obtained by binarization of at the bright side level ($A+\alpha$). However, it appears that the Examiner is misreading this limitation. The limitation in full states “binarizes the brightness information so as to form the image of only the second connected part by a bright side level ($A+\alpha$) brighter than a reference brightness level (A) of the transmission image of the first connected part when the object has only the first connected part and by a dark side level ($A-\beta$) darker than the reference brightness level.” As can be seen from the underlined portions of this limitation, it is apparent that the bright side level is referring to the first connected part. As a result, withdrawal of this rejection under 35 U.S.C. §112, first paragraph, is respectfully requested.

Claims 1, 2, 6-8, 11 and 12 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Heumann (US 6,201,850) and Baker (US 4,926,452) in view of Garland (US 6,256,406). Claims 3-5, 9, 10, 13, 14, 21, 24, 28, 29 and 33 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Heumann and Baker in view of Garland and further in view of Koike (US 5,836,504). Claims 17-20, 22, 23, 25-27 and 30-32 have been indicated as containing allowable subject matter. The Applicants would like to thank the Examiner for this indication of allowable subject matter.

Claims 1, 7 and 11 have been amended so as to include the limitations of claims 2, 8 and 12, respectively, and claims 2, 8 and 12 have been cancelled.

In addition, claims 1,3-7, 9-11 and 13-33 have been amended to make a number of editorial revisions. These revisions have been made to place the claims in better U.S. form. None of these amendments have been made to narrow the scope of protection of the claims, nor to address issues related to patentability and therefore, these amendments should not be construed as limiting the scope of equivalents of the claimed features offered by the Doctrine of Equivalents.

The above-mentioned claim rejections are respectfully traversed and submitted to be inapplicable to the claims for the following reasons.

Claim 1 is patentable over the combination of Heumann, Baker and Garland, since claim 1 recites a connection inspecting apparatus having, in part, a sub-thickness image forming device for forming a plurality of sub-thickness images corresponding respectively to a plurality of transmission images of a plurality of different storage times supplied from the imaging device based on a relationship between a brightness density of the plurality of transmission images and a thickness of the connected part, and a superimposed image forming device for forming a thickness superimposed image of a connected part by adding the plurality of the sub-thickness images to each other, wherein the superimposed image forming device forms the thickness superimposed image of the connected part by adding the plurality of sub-thickness images to each other when a value of the thickness of the connected part is within a certain range, and extracts and collects only valid parts of the plurality of sub-thickness images, respectively, so as to form the thickness superimposed image when the value of the thickness of the connected part is not within the certain range. The combination of the

references fails to disclose or suggest a sub-thickness image forming device or a superimposed image forming device as recited in claim 1.

Heumann discloses an X-ray inspection system that includes an X-ray tube 200 that emits X-rays 284, a fluorescent screen 250 that converts the X-rays 284 to visible light 286, and a camera 258 which detects the visible light 286. The X-ray inspection system also includes a computer 270 (having RAM and a frame grabber memory) that controls the overall operation of the system. (See column 22, line 47 - column 24, line 19 and Figure 4A (Heumann) and see column 21, line 35 - column 22, line 31 and Figure 11 (Baker)). It is apparent that Hermann (and Baker) fails to disclose or suggest either a sub-thickness image forming device or a superimposed image forming device as recited in claim 1, since, as admitted in the rejection, Hermann does not disclose or suggest obtaining a plurality of transmission images having different storage times and forming a thickness superimposed image by adding a plurality of sub-thickness images. To address these deficiencies, the rejection indicates that exposure compensation is well-know and relies on Garland as supporting this conclusion.

Garland discloses that it is difficult to produce a diagnostic image of uniform optical density when examining a body part that varies greatly in thickness or tissue composition and that compensation filters are often used to address this problem (See column 1, line 25 - column 2, line 22). The rejection states that it would have been obvious to superimpose images from valid parts because of the differences in thicknesses of the parts would lead to either under exposure or over exposure during X-raying. However, based on the above-cited disclosure of Garland, it is apparent that the problem of either over exposure or under exposure is corrected by the compensation filters and not by superimpose images from valid parts. Since the section of Garland teaches a manner of addressing the exposure problem that is completely different than that indicated in the rejection as being an obvious solution based on the disclosure in the section, it is apparent that there is no basis for the rejection's conclusion and the conclusion is based on hindsight.

Further, it is apparent that none of Hermann, Baker and Garland disclose or suggest a superimposed image forming device that forms a thickness superimposed image of a connected part by adding a plurality of sub-thickness images to each other when a value of a thickness of the connected part is within a certain range, and extracts and collects only valid parts of the plurality of

sub-thickness images, respectively, so as to form the thickness superimposed image when the value of the thickness of the connected part is not within the certain range. As a result, the combination of Heumann, Baker and Garland fails to disclose or suggest the present invention as recited in claim 1.

In section 9 of the Office Action, Koike is relied on as disclosing subtracting a one-side X-ray transmission from a both-side X-ray transmission. However, Koike also fails to disclose or suggest a sub-thickness image forming device or a superimposed image forming device as recited in claim 1.

As for claims 7 and 11, they are patentable over the references relied upon in the rejections for the same reasons as set forth above in claim 1. That is, claims 7 and 11, like claim 1, recite forming a plurality of sub-thickness images corresponding respectively to a plurality of transmission images of a plurality of different storage times based on a relationship between a brightness density of the plurality of transmission images and a thickness of the connected part, and forming a thickness superimposed image of a connected part by adding the plurality of the sub-thickness images to each other, wherein the thickness superimposed image of the connected part is formed by adding the plurality of sub-thickness images to each other when a value of the thickness of the connected part is within a certain range, and only valid parts of the plurality of sub-thickness images are extracted and collected, respectively, so as to form the thickness superimposed image when the value of the thickness of the connected part is not within the certain range, which features are not disclosed or suggested in the references.

Claim 14 is patentable over the combination of Heumann, Baker, Garland and Koike, since claim 14 recites an irradiation device having, in part, an image forming device for forming brightness information based on a transmission image supplied from an imaging device of a first connected part and a second connected part of an object to be inspected which overlap at an overlapping part in a thicknesswise direction thereof, and for forming an image of only the second connected part based on the brightness information. The combination of the references fails to disclose or suggest an image forming device as recited in claim 14.

As discussed above, Heumann (Baker) discloses an X-ray inspection system that includes an X-ray tube 200 that emits X-rays 284, a fluorescent screen 250 that converts the X-rays 284 to visible light 286, and a camera 258 which detects the visible light 286. The X-ray inspection system also

includes a computer 270 (having RAM and a frame grabber memory) that controls the overall operation of the system. (See column 22, line 47 - column 24, line 19 and Figure 4A (Heumann) and see column 21, line 35 - column 22, line 31 and Figure 11 (Baker)). It is apparent that Baker discloses that images are captured from the camera 258 and are stored in the frame grabber memory to be used for inspection.

However, the image forming device recited in claim 14 forms brightness information based on a transmission image supplied from an imaging device of a first connected part and a second connected part of an object to be inspected which overlap at an overlapping part in a thicknesswise direction thereof, and forms an image of only the second connected part based on the brightness information. It is apparent from the above discussion of Heumann (Baker) that the computer 270 relies solely on the images captured from the camera 258 in performing the inspection operation. There is no disclosure or suggestion in Heumann (Baker) of forming brightness information from the stored images and forming an image based on the brightness information.

One of the benefits that the present invention has over the X-ray inspection system of Heumann is that since the brightness information is used to form the image of only the second connected part, the amount of memory needed in the image forming device is lower than that of the the X-ray inspection system of Heumann, since Heumann only utilizes that actual image.

As for Garland and Koike, these references are relied on as disclosing exposure compensation and subtracting a one-side X-ray transmission from a both-side X-ray transmission, respectively. However, neither of these references discloses or suggests an image forming device as recited in claim 14.

As for claims 24 and 29, they are patentable over the references relied upon in the rejections for the same reasons as set forth above in claim 14. That is, claims 24 and 29, like claim 14, recite forming brightness information based on a transmission image of a first connected part and a second connected part in an overlap state, and forming an image of only the second connected part based on the brightness information, which features are not disclosed or suggested in the references.

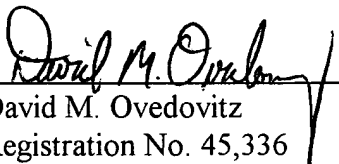
Because of the above mentioned distinctions, it is believed clear that claims 1,3-7, 9-11 and 13-33 are allowable over the references relied upon by the Examiner. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention

would not have been motivated to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 1,3-7, 9-11 and 13-33. Therefore, it is submitted that claims 1,3-7, 9-11 and 13-33 are clearly allowable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

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